MX-62-044

TECHNICAL MANUAL

OPERATION INSTRUCTIONS

RADIO SET AN/URC-99 AND AN/URC-99A (USED IN COMMUNICATIONS CENTRALS AN/MRC-108( ) FOR HAVE QUICK MODIFICATION

Magnavox Government and Industrial Electronics Company
Contract No. F19628-79-C-0051 and F19628-85-C-0016

This manual supersedes TO 12R2-2URC-101-2, dated 1 March 1983

This publication is required for official use or for administrative or operational purposes only. Distribution is limited to U.S. Government agencies. Other requests for this document must be referred to Warner Robins ALC/MMEDT, Robins AFB, GA. 31098-5609.

Published under authority of the Secretary of the Air Force

TECHNICAL MANUAL

OPERATION INSTRUCTIONS

RADIO SET AN/URC-99 AND AN/URC-99A (USED IN COMMUNICATIONS CENTRALS AN/MRC-108( ) FOR HAVE QUICK MODIFICATION

Magnavox Government and Industrial Electronics Company
Contract No. F19628-79-C-0051 and F19628-85-C-0016

This manual supersedes TO 12R2-2URC-101-2, dated 1 March 1983

This publication is required for official use or for administrative or operational purposes only. Distribution is limited to U.S. Government agencies. Other requests for this document must be referred to Warner Robins ALC/MMEDT, Robins AFB, GA. 31098-5609.

Published under authority of the Secretary of the Air Force

LIST OF EFFECTIVE PAGES

INSERT LATEST CHANGED PAGES. DESTROY SUPERSEDED PAGES.

NOTE: The portion of the text affected by the changes is indicated by a vertical line in the outer margin of the page. Changes to illustrations are indicated by miniature pointing hands. Changes to wiring diagrams are indicated by shaded areas.

Date of issue for original and changed pages are:

Original . . 0 . . 1 April 1986

TOTAL NUMBER OF PAGES IN THIS PUBLICATION IS 42 CONSISTING OF THE FOLLOWING:

Page No.	* Change No.
Title	0
A	0
i - iii	0
1-0	0
1-1 - 1-14	0
2-1 - 2-18	0
INDEX 1 - INDEX 3	0
INDEX 4 blank	0

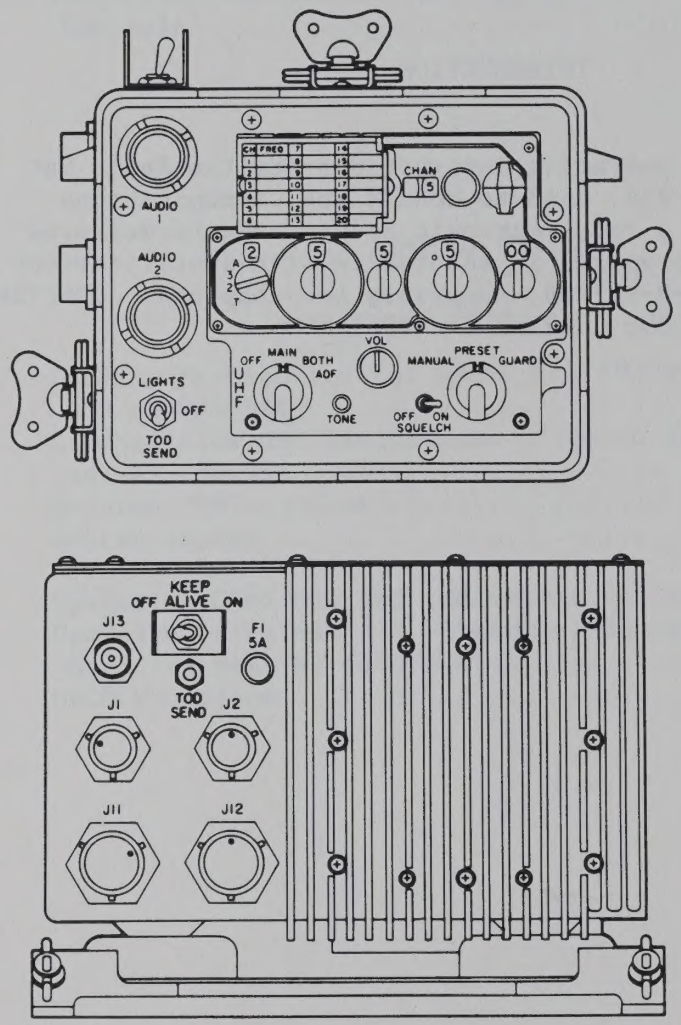
* Zero in this column indicates an original page.

TABLE OF CONTENTS

NOTE

An alphabetical index is located at the back of this manual. The introduction (preceding Chapter 1) explains the material covered by each chapter.

Chap/Sect/Para		Page
	INTRODUCTION	iii
CHAPTER 1.	GENERAL INFORMATION	
1-1.	DESCRIPTION	1-1
1-2.	PURPOSE OF EQUIPMENT	1-1
1-3.	EQUIPMENT DESIGNATION DETERMINATION PROCEDURE	1-1
1-4.	AJ MODE	1-2
1-5.	WOD	1-2
1-6.	TOD	1-2
1-7.	NET NUMBERS	1-2
1-8.	EQUIPMENT CHARACTERISTICS	1-3
1-9.	CAPABILITIES AND LIMITATIONS	1-3
1-10.	RELATED PUBLICATIONS	1-3
1-11.	ABBREVIAITONS	1-3
CHAPTER 2.	OPERATION	
Section I.	CONTROLS AND INDICATORS	2-1
2-1.	CONTROLS AND INDICATORS	2-1
Section II.	OPERATION INSTRUCTIONS	2-7
2-2.	OPERATION INSTRUCTIONS	2-7
2-3.	OPERATING PROCUDERES	2-7
2-4.	NORMAL MODE OPERATING PROCEDURES	2-7
2-5.	AJ MODE OPERATING PROCEDURES	2-9
2-6.	SECURE VOICE	2-17
Section III.	EMERGENCY OPERATION	2-18
2-7.	EMERGENCY OPERATION	2-18
INDEX		INDEX 1



RADIO SET CONTROL
C-10905/URC-99

ELECTRICAL EQUIPMENT
MOUNTING BASE
MT-6165/URC

URC101-04

Figure 1-1. Radio Set AN/URC-99 and AN/URC-99A

CHAPTER 1

GENERAL INFORMATION

1-1. DESCRIPTION. The AN/URC-99 Radio Set (URC-99) is equipped with either a Receiver-Transmitter RT-1145A/ARC-164(V) (RT-1145A) or a RT-1145C/ARC-164(V) (RT-1145C) and is controlled by Radio Set Control C-10905/URC-99 (C-10905). The AN/URC-99A Radio Set (URC-99A) is equipped with a Receiver-Transmitter RT-1504/ARC-164(V) (RT-1504) and is also controlled by the C-10905. The RT-1145A and RT-1145C receiver-transmitters (URC-99) utilize standard Have Quick single WOD circuitry to operate in the AJ (anti-jam) mode. The RT-1504 (URC-99A) incorporates a modified synthesizer/-ECCM slice which allows multiple WOD capability (discussed in paragraph 1-5). To determine whether the equipment being operated is URC-99 or URC-99A, perform the procedure in paragraph 1-3. Operating procedures supplied in this document provide sufficient instruction for either radio set. In the narrative of the following paragraphs, information that applies to all equipment covered by this document will be presented in generic terms with respect to equipment names. Terms such as radio set, control, and RT will be used instead of the specific equipment nomenclature.

1-2. PURPOSE OF EQUIPMENT. The purpose of the radio set used in the Communications Centrals AN/MRC-108( ), is to provide ground-to-air and ground-to-ground voice communications in the 225.000 MHz to 399.975 MHz military band. In a communications-jamming environment, the AJ mode enables the radio set to operate with other radios similarly equipped with an AJ capability.

1-3. EQUIPMENT DESIGNATION DETERMINATION PROCEDURE. To determine which system procedures are applicable, it is necessary to ascertain which system you are using. The URC-99 radio set will operate in the AJ mode with a net number ending with 00, 25, 50 or 75; however, the URC-99A will issue a pulsating warning tone when a net number ending with 75 is used. To accomplish this determination perform the following procedure.

a. Load WOD in accordance with paragraph 2-5d(1).

b. Receive TOD in accordance with paragraph 2-5b.

c. Enter the net number in accordance with paragraph 2-5f. Use net number ending with 75.

NOTE

At this point, a URC-99 system will operate without a pulsating warning tone; whereas, a URC-99A system will issue a pulsating warning tone.

1-4. AJ MODE. The AJ mode of operation provides jam-resistant capability by taking advantage of the rapid tuning ability of the radio set. Automatically changing the frequency many times per second is a technique called frequency-hopping. To permit frequency-hopping, three special entries are required. These are word-of-day (WOD), time-of-day (TOD), and a valid net number. In order that several stations be given ECCM capability, several stations use WOD and TOD and share a common net number. The URC-99 radio set utilizes the standard WOD loading method (only one WOD may be loaded into the radio). The URC-99A radio set is capable of being loaded with multiple (up to six) WODs (MWOD) at one time.

1-5. WOD. This programs the frequency-hopping rate and frequency-hopping pattern. In the URC-99, the WOD is entered into preset memory; however, in the URC-99A, the WOD is entered in memory accessed by the preset channels 20 through 15. The memory being accessed is non-volatile and is located in the SYNTH/ECCM slice. For both radios WOD length may vary and may require anywhere from one to six channel locations. Up to six WODs may be entered at one time, allowing for multi-day use of the radio set without installing another WOD. The procedure for loading multiple WODs is called MWOD loading. Each WOD entered has a date code attached to it (in memory location accessed by channel 14), that works in conjunction with TOD. The radio cannot function in the AJ mode without a valid WOD. In the URC-99A, channels containing WOD can now be used for preset operation, since the WOD does not take up preset memory as in the URC-99.

1-6. TOD. TOD synchronization is necessary for communicating in the AJ mode. The TOD places the radio in synchronization with all other radios with the same WOD and TOD so they can frequency hop at the same time. The radio automatically accepts the first TOD signal received after power-up. Subsequent transmissions of TOD are ignored unless the operator enables the radio to receive a new TOD. The operator may also send TOD contained in his radio to other radios similarly equipped.

1-7. NET NUMBERS. The net number is used in the AJ mode in the same fashion as a non-AJ mode frequency. Radios with the same net number, WOD, and TOD will be able to communicate in the AJ mode. To communicate with radios using a different net number, you must change to that radio net number. The following paragraphs explain full-up and training net numbers.

a. URC-99 Net Numbers. For URC-99 radios, all possible net numbers are legal and valid. The last two digits (00, 25, 50, or 75), are used to enable or disable conferencing. Possible combinations allow for 1,000 different net numbers.

b. URC-99A Net Numbers. For URC-99A radios, the last two digits of the net number do not enable or disable conferencing, they instead distinguish the net structure being used (NATO, non-NATO, etc.). With URC-99A radios there are 3,000 possible net numbers: 1,000 original A and B nets (ending with 00); 1,000 NATO nets (ending with 25); and 1,000 non-NATO nets (ending with 50). Net numbers ending with 75 will issue a pulsating warning tone designating an illegal net.

c. Training Net Numbers. When standard T-net operation is utilized (in either radio set), there are five T-net numbers that can be used (A00.000 - A00.400). In the URC-99A radio, when FMT-net operation is used, there are 16 net numbers available (A00.025 - A01.525). In T-net operation, the radio will use the five frequencies loaded in with the WOD, and in the FMT-net operation, the radio will use the sixteen FMT frequencies. Selection of any other net number while operating in T-Net or FMT-net training mode is illegal and will cause an alarm.

1-8. EQUIPMENT CHARACTERISTICS. The electrical mounting base for the RT-1145A, RT-1145C, or RT-1504 is the MT-6165/URC (MT-6165). The radio set provides a 7000 channel uhf tuneable receiver; an auxiliary guard receiver (nominally 243.000 MHz, tuneable from 238.000 to 248.000 MHz, with crystal replacement and realignment), and a 7000 channel, 10-watt carrier transmitter for normal am voice communications and communications in the AJ mode of operation. Leading particulars for the radio set, as used in the AN/MRC-108( ), are listed in table 1-1.

1-9. CAPABILITIES AND LIMITATIONS. Capabilities and limitations of the radio set are listed in table 1-2.

1-10. RELATED PUBLICATIONS. Related publications for the radio set are listed in table 1-3.

1-11. ABBREVIATIONS. Abbreviations and their definitions used in this publication are listed in table 1-4.

Table 1-1. Leading Particulars for Radio Set AN/URC-99 and AN/URC-99A

Characteristics	Description
Communication Systems	AN/MRC-108( ) Communications Centrals
Operating Temperature	-54 deg C to +60 deg C
Storage Temperature	-62 deg C to +85 deg C
Altitude	50,000 ft (15.24 km) max
Humidity	Up to 100% (including conditions of condensation on and in the equipment in temperatures up to +50 degrees C)
Vibration	5 g's at 2,000 Hz
Shock	50 g's for 11 ms duration
Main Receiver Reception Types	AM voice and tone AM wideband data (diphase) AM narrowband data (baseband)
Guard Receiver	Fixed tuned crystal controlled uhf receiver
Guard Receiver Reception Types	AM voice and AM tone modulated RF
Guard Frequency	243.000 MHz (tuneable from 238.000 MHz to 248.000 MHz)
Transmitter Transmission Types	AM voice AM wideband data (diphase) AM narrowband data (baseband)
Switching Unit	Electrically interfaces with any and all versions of Have Quick radios
Time Keeping	Maintains time as required for a four (4) hour mission
Warmup Time	Meets all operating requirements within 10.0 seconds after turnon

Table 1-1. Leading Particulars for Radio Set AN/URC-99 and AN/URC-99A - Continued

Characteristics	Description
Receiver-Transmitter RT-1504/ARC-164(V) RT-1145A/ARC-164(V) RT-1145C/ARC-164(V)	
Width	4.98 in. (12.65 cm)
Height	4.73 in. (12.03 cm)
Depth*	8.25 in. (20.96 cm)
Weight	8.50 lb (3.86 kg)
Electrical Equipment Mounting Base MT-6165/URC	
Width	9.51 in. (24.16 cm)
Height	7.08 in. (17.97 cm)
Depth*	16.94 in. (43.03 cm)
Weight	27.00 lb (12.25 kg)
Radio Set Control C-10905/URC-99	
Width	7.50 in. (19.05 cm)
Height	6.25 in. (15.88 cm)
Depth*	5.34 in. (13.56 cm)
Weight	5.31 lb (2.49 kg)

* Depth dimension includes projecting controls and connectors.

Table 1-2. Capabilities and Limitations of Radio Set AN/URC-99 and AN/URC-99A

Characteristics	Description
General	
Uhf Antenna	Transmit - 50 ohm impedance Receive - 52 ohm impedance
Frequency Range	225.000 to 399.975 MHz
Tuning Capabilities	7000 channels
Transmitter Power Out	10 Watts
Receiver Sensitivity	4 micro-Volts for 10 dB S+N/N at 30% modulation
Channel Spacing	0.025 MHz
Preset Channels	19 available in normal mode. For RT-1504, channel 20 is reserved for mode selection. For RT-1145A or RT-1145C, channels 20 through 15 reserved for WOD elements. (Any presets, 19 through 15, not used for WOD elements can be used for normal preset.)
Memory Type	CMOS RAM, CMOS EPROM, CMOS EEPROM
Secure Speech Capability	Diphase and baseband modes
Spectral Containment	99% +/-12.5 kHz (diphase: +/-25 kHz) of the carrier frequency
Derating of Parts	Junction temperatures not covered by ESD-TR-83-197 have the following conditions: Power devices: 150 deg. C (302 deg. F) Small signal devices: 125 deg. C (257 deg. F)

Table 1-2. Capabilities and Limitations of Radio Set AN/URC-99 and AN/URC-99A - Continued

Characteristics	Description
Intercommunication Set Termination	150 ohms +/-30% input impedance 600 ohm X-mode input impedance
Operating Modes	AM Voice Tone ADF Secure Speech (KY-58 only in AJ mode) AJ
Sensitivity to Receive Signals	Receives AM signals at levels between -101 dBm to +2 dBm
Alignment and Adjustment	None at organizational level, minimal at intermediate level
TOD Transfer Modes	Normal and AJ
Take Control Capability	Permits interconnection of more than one remote control to a remote RT; also, allows for remote control of a panel mount radio
X-Mode Input Impedance	600 +/-20% resistive impedance
Reverse Polarity Protection	Protects circuitry from inadvertent connection to a dc power source of wrong polarity
Input Voltage	24 Vdc, +8/-6 Vdc (with transient protection for up to 600 Vdc from 0 to 10 microseconds)
Operating Voltage	27.5 Vdc (Standard Condition) 24 to 33 Vdc (Service Condition) 18 Vdc (Emergency Condition)

Table 1-2. Capabilities and Limitations of Radio Set AN/URC-99 and AN/URC-99A - Continued

Characteristics	Description
Environmental Conditions:	
NOTE The equipment is designed to operate and withstand the environmental conditions as specified in Mil-E-5400 for Class I equipment, except as shown with the following deviations.	
Operating Temperature Range	-54 deg. C to +55 deg. C (operable for 30 minute intervals at +71 deg. C)
Non-Operating Temperature Range	-62 deg. C to +85 deg. C
Thermal Shock	Withstands temperature gradient of one degree per second from -62 deg. C to +85 deg. C
Altitude	Sea level to 50,000 ft.
Humidity	100% (including conditions of condensation on and in the equipment in temperatures up to +50 deg. C)
Ambient Pressure Change	From room ambient to 1.69 p.s.i.a. either solid state or with maximum rate of change of 0.25 p.s.i.a. per second
Main Receiver Performance Capabilities:	
Types of Reception	AM voice and tone AM wideband data (diphase) AM narrowband data (baseband)
Audio Outputs	Voice - Ungrounded 150 ohm or 600 ohm narrowband impedance (selectable) X-mode - 500 ohm impedance

Table 1-2. Capabilities and Limitations of Radio Set AN/URC-99 and AN/URC-99A - Continued

Characteristics	Description
Sensitivity	4 microvolts (hard) for 10 dB (S+N)/N at 30% modulation at 1 kHz
Audio Frequency Response	Voice - +1 dB, -3dB of audio output X-mode - +/-3 dB (70 Hz to 20 kHz and 20 Hz to 25 kHz); +3, -5 dB in diphase operation Baseband - +/-3 dB from 20 Hz to 12 kHz
Audio Distortion	<10%
Power Level	Voice - 200 mW minimum not to exceed 360 mW (test) X-mode - 2.00 Vrms across 500 ohms, rf input of 1000 microvolts modulated 90% at 1 kHz
AGC	At 1000 microvolts antenna input modulated 30% at 1000 Hz, audio output variance is +5 dB/-4 dB
Squelch Sensitivity	Carrier-to-noise ratio type, open at signal level of 4 microvolt or less: Attack time: 50 ms max. (at 90% of steady state ON level) Release time: 150 ms max. (at 10% of steady state ON level)
Input Impedance	Creates SWR <2.5:1 on 52 ohm transmission line
CLIMAX Compatibility Squelch	Squelch based on carrier-to-noise ratio for signals below -87 dBm +/-6 dB. Squelch based on AGC for signals above -87 dBm +/-6 dB.

Table 1-2. Capabilities and Limitations of Radio Set AN/URC-99 and AN/URC-99A - Continued

Characteristics	Description
Selectivity	Narrowband - 6 dB down from nominal frequency for frequencies 12 kHz from nominal 40 dB down from nominal frequency for frequencies 25 kHz from nominal Wideband - 6 dB down from nominal frequency for frequencies 35 kHz from nominal 60 dB down from nominal frequency for frequencies 75 kHz from nominal
Vibration Modulation	<2 dB variation in output due to vibration
Guard Receiver Performance Capabilities:	
Type	Fixed tuned crystal controlled uhf receiver
Audio Output	Common with main receiver, within +/-2 dB of main receiver
Speech Security Output	Isolated from main receiver; terminated in 600 ohm load
Selectivity	6 dB down from nominal frequency for frequencies 30 kHz from nominal 60 dB down from nominal frequency for frequencies 80 kHz from nominal
Frequency Adjustment	Pre-adjusted 243.000 nominal operating frequency; adjustable from 238.000 MHz to 248.000 MHz
AJ Override	Overrides radio set AJ mode and sets radio to normal mode at 243.000 MHz

Table 1-2. Capabilities and Limitations
of Radio Set AN/URC-99 and AN/URC-99A - Continued

Characteristics	Description
Frequency Accuracy	+/-0.0075 MHz from nominal
Transmitter Performance Capabilities:	
Types of Transmission	AM voice and tone AM wideband data (diphase) AM narrowband data (baseband)
Power Level Out	10 watt unmodulated output
AM Modulation	At 1000 Hz and 1.4 Volt input, negative and positive modulation = 80% minimum
Carrier Distortion	<10% between 300 and 3500 hz at 1.0 volt
Carrier Noise Level	>40 dB below detected audio from carrier modulated 80% positive at 1000 hz
Modulator Input Impedance	150 ohms +/-30%
Transmitter Rise Time	90% rf power in 70 +/-10 ms (normal mode); no power output between 0 to 40 ms
Sidetone Level	At 1.4 Vrms input voltage, >100 mW sidetone output
Sidetone Distortion	<15% between 300 and 3500 Hz at 1.0 Vrms audio input
Tone Modulation	At 1020 Hz +/-20%, minimum negative modulation = 80%, minimum positive modulation = 80%
Frequency Deviation	<0.0005 MHz from nominal frequency
Peak Frequency Deviation	<2.0 kHz at 1000 Hz with 80% positive modulation
Frequency Hop Settle Time	Within 2 kHz of center frequency in 7.5ms

Table 1-2. Capabilities and Limitations of Radio Set AN/URC-99 and AN/URC-99A - Continued

Characteristics	Description
Switching Unit:	
Clock Frequency	620 Hz +/-20%
Clock Format	32 pulses followed by blank period equaling 8 clock pulses
Clock Phasing	Clock + and clock - are 180 degrees out of phase
Clock Output Levels	2.4 volts minimum for HI state, 0.8 volts maximum for LO state
Data Phasing	Data + and data - are 180 degrees out of phase
Data Output Levels	2.4 volts minimum for HI state, 0.8 volts maximum for LO state
Data Bit Identification	All data bits are negative logic, except bits 14 through 27 which are positive logic

Table 1-3. Related Publications

Technical Order	Subject
TO 12R2-2URC-102	Intermediate Maintenance Instructions Radio Set AN/URC-98, -98A, -99, and -99A
TO 12R2-2URC-103	Depot Maintenance Instructions Radio Set AN/URC-98, -98A, -99, and -99A
TO 12R2-2URC-104	Illustrated Parts Breakdown Radio Set AN/URC-98, -98A, -99, and -99A
TO 31R2-2MRC108-2-2	Supplemental Technical Manual Service and Circuit Diagrams Communications Centrals AN/MRC-108 and AN/MRC-108A with Have Quick Modifications
KAO-168B/TSEC	TSEC/KY-57/58 Speech Security Equipment Operator's Manual
KAO-153A/TSEC	TSEC/KY-28 Speech Security Equipment Operator's Manual

Table 1-4. Abbreviations

Abbreviation	Definition
ADF	Automatic Direction Finding
AJ	Anti-Jam
BW	Bandwidth
CNG	Change
ECCM	Electronic counter-countermeasures
EEPROM	Electrically-Eraseable Programmable Read Only Memory
FMT	Frequency Management Training
GMT	Greenwich Mean Time
LRU	Line Replaceable Unit
MN	Main
M-P-G	MANUAL-PRESET-GUARD
MWOD	Multiple Word-of-Day
NB	Narrowband
RT	Receiver-Transmitter
SQ	Squelch
TOD	Time-of-Day
UTC	Universal Coordinated Time
WB	Wideband
WOD	Word-of-Day

CHAPTER 2

OPERATION

Section I. CONTROLS AND INDICATORS

2-1. CONTROLS AND INDICATORS. Operating controls and indicators of the system are all contained on the C-10905 switching unit front panel and the front panel of the MT-6165, and are listed and illustrated in tables 2-1 and 2-2 and figures 2-1 and 2-2.

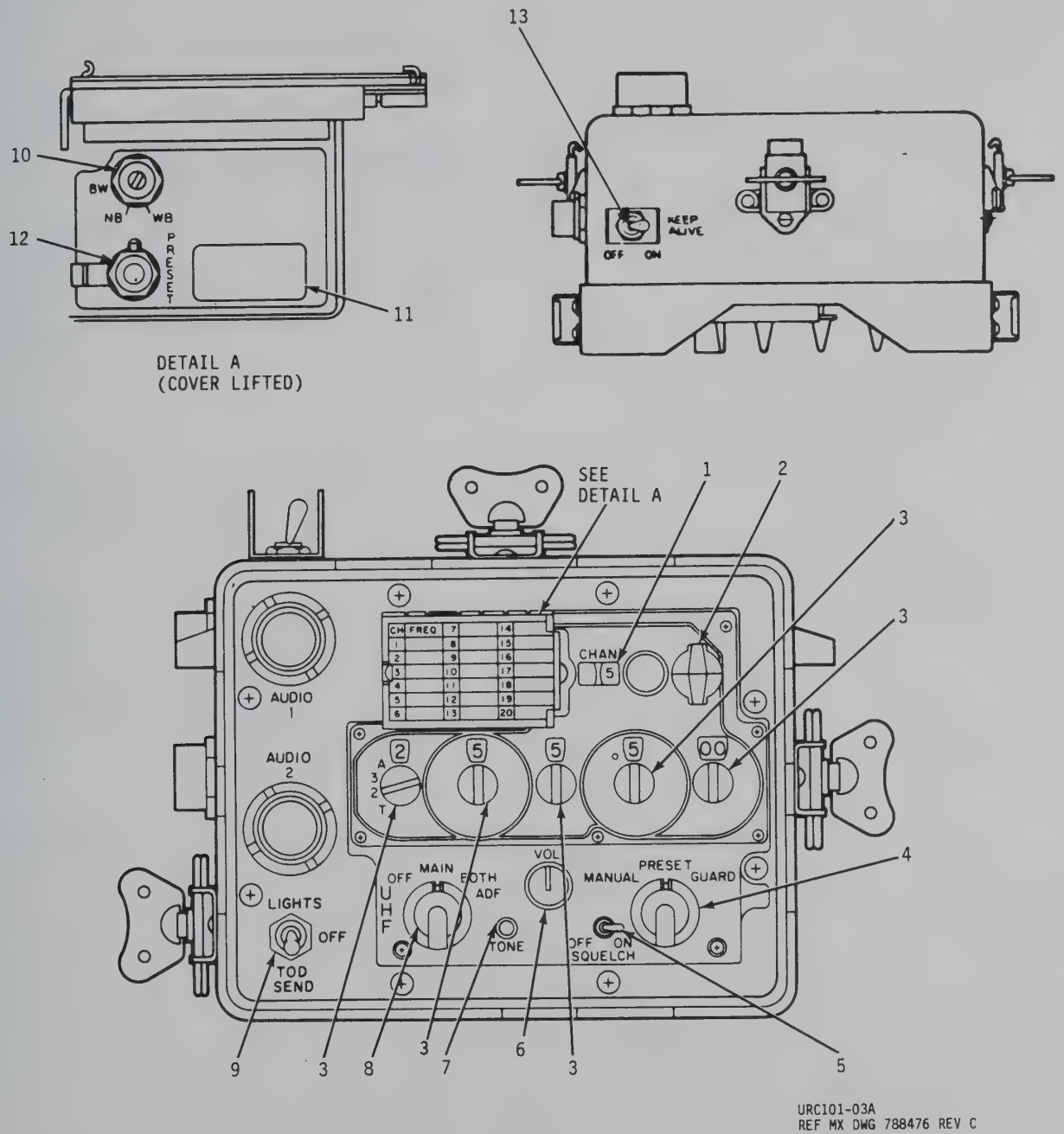


Figure 2-1. Switching Unit Operating Controls and Indicators

Table 2-1. Operating Controls and Indicators for Switching Unit

Reference (Figure 2-1)	Nomenclature	Function
1	Channel indicator	Displays current channel location.
2	Channel switch	In normal mode, allows storage of selected frequency, and selection of stored frequency, in selected preset channel (1-19). In MWOD load mode, is used as memory location access switch (SYNTH/ECCM memory).
3	Frequency switches	The frequency switches select among several functions. The switches are used to select modes, frequencies, WOD's, or net numbers. An overview of the functions is as follows. T-2-3-A: T - The T position is a momentary, spring-return position enabling input of TOD, or for emergency clock start. 2, 3 - The operator can use the 2 or 3 position to select the 100's digit of the desired frequency in normal mode, or the 100's digit of the WOD element for AJ mode. A - The A position is used to select the AJ mode of operation.

Table 2-1. Operating Controls and Indicators for Switching Unit - Continued

Reference (Figure 2-1)	Nomenclature	Function
3- continued		Tens, units, tenths, and thousandths: These switches select the corresponding digit of the desired frequency in normal mode, and the corresponding digit of the WOD or net number for AJ mode.
4	MANUAL-PRESET-GUARD (M-P-G) switch	Selects the method of frequency selection as follows. MANUAL - Frequency is manually selected using the five frequency switches. PRESET - Frequency is selected using channel switch; also used when programming the 20 preset channels. GUARD - Main receiver and the transmitter are automatically tuned to the guard frequency and the guard receiver is disabled.
5	SQUELCH ON-OFF switch	Enables and disables squelch of main receiver.
6	VOL control	Adjusts audio level.
7	TONE switch	When pressed, transmits TOD followed by a 1020 Hz tone on the selected frequency, when the radio TOD clock has been started. Is used in conjunction with the T-2-3-A switch for emergency clock start. In normal mode is used as a tone transmission switch only. In MWOD loading mode, is used to load MWOD into memory.

Table 2-1. Operating Controls and Indicators for Switching Unit - Continued

Reference (Figure 2-1)	Nomenclature	Function
8	Function switch (OFF-MAIN-BOTH-ADF)	Selects the overall RT operating function. OFF - Shuts down the equipment. MAIN - Enables main receiver and transmitter. BOTH - Enables main receiver and transmitter and guard receiver. ADF - Enables ADF or homing system (if installed) and main receiver. Disables guard receiver.
9	LIGHTS/TOD SEND Switch	In LIGHTS position, illuminates the panel lights. In TOD SEND position, enables radio set to transmit hardwire TOD.
10	BW switch (NB-WB)	Selects wideband or narrowband selectivity of main receiver.
11	LED Frequency Indicator	Indicates frequency currently addressed in memory.
12	PRESET switch	Stores selected data in specified preset channel. Is also used as mode change enable switch.
13	KEEP ALIVE Switch	Switches the application of internal and external power to the KEEP ALIVE circuit.

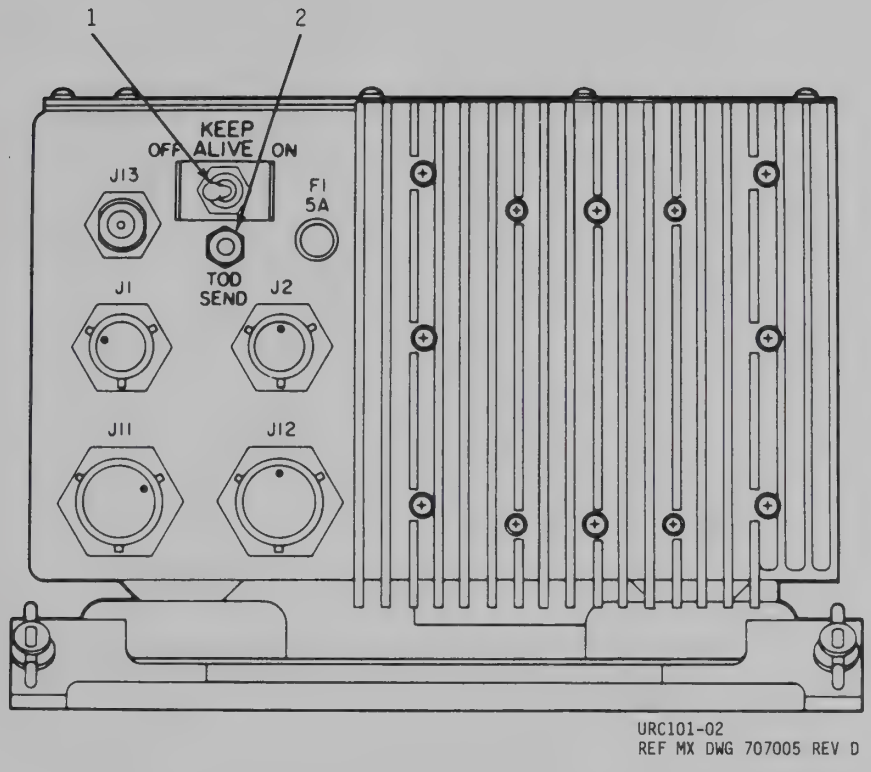


Figure 2-2. Electrical Equipment Mounting Base MT-6165/URC Controls

Table 2-2. Operating Controls for
Electrical Equipment Mounting Base MT-6165/URC

Reference (Figure 2-2)	Nomenclature	Function
1	KEEP ALIVE ON/ OFF Switch	Connects power to the Keep-alive circuits to prevent loss of TOD during power interruptions. NOTE The KEEP ALIVE switch should always be in the ON position when the system is in operation. When it is necessary to shut down power for any reason, set the switch to the OFF position to prevent drainage of the vehicle battery.
2	TOD SEND Switch	Enables hardwire TOD transfer.

Section II. OPERATION INSTRUCTIONS

2-2. OPERATION INSTRUCTIONS. Operating instructions for the radio set are presented in this section. The instructions include procedures for operating in normal mode, AJ mode, and secure voice mode. For normal mode operation, procedures are provided for turn-on of the equipment, loading of presets, and normal two-way communications. For AJ mode operation, procedures are provided for receiving and sending TOD, loading WOD (single and multiple), and operating in the AJ mode.

2-3. OPERATING PROCEDURES. For proper operation of the radio set in all modes, perform the following procedures.

2-4. NORMAL MODE OPERATING PROCEDURES. The following normal mode operating procedures include procedures for turn-on; preset channel loading; normal two-way voice; constant monitoring of guard channel; guard operation; and, automatic direction finding.

a. Turn-On Procedure. To turn on the equipment, proceed as follows:

(1) Rotate the VOL control knob fully counter-clockwise.

(2) Rotate the M-P-G switch to the MANUAL position.

(3) Rotate the T-2-3-A switch to the 3 position.

(4) Rotate the function switch to the MAIN position.

(5) Using the channel switch, select channel 20.

(6) Using the frequency switches, select 220.000 MHz.

(7) Rotate the M-P-G switch to the PRESET position.

(8) Lift the access cover assembly, (detail A, figure 2-1) and then press and release the PRESET pushbutton.

(9) Set the SQUELCH switch to the OFF position.

(10) Rotate the VOL control clockwise and adjust the volume for the desired level in the headset.

NOTE

Rushing noise will be heard in headset.

(11) Set the SQUELCH switch to the ON position.

b. Preset Channel Loading Procedure. To load frequencies into preset channels for preset mode of operation, proceed as follows.

(1) Having turned on the RT in accordance with the turn-on procedure, rotate the M-P-G switch to the PRESET position.

(2) Using the frequency switches (5, figure 2-1), select the desired operating frequency.

(3) Rotate the channel switch (3, figure 2-1) to the desired channel number. Do not select channel twenty (20).

(4) Press and release the PRESET pushbutton.

(5) Using a soft lead (erasable) pencil and the channel frequency chart, record the frequency selected for the displayed preset channel.

(6) To load additional preset channels, repeat steps b through e.

(7) Close the access cover assembly when all preset channels have been loaded, and return function switch to MANUAL.

c. Normal Two-Way Voice. To operate in the normal two-way voice mode of operation, proceed as follows:

(1) After following the turn-on procedure, use the manual frequency switches to select the desired operating frequency. The T-2-3-A switch should be placed in the 2 or 3 position, depending on the desired operating frequency.

NOTE

If preset operation is desired, refer to the previous procedure for loading PRESET channels. Rotate the M-P-G switch to PRESET, then select the desired frequency with the channel switch. If guard operation is desired, rotate the M-P-G switch to GUARD position.

(2) Press the push-to-talk switch and communicate with another station. Talk normally into the headset microphone and verify that sidetone is present.

(3) Release the push-to-talk switch.

d. Constant Monitoring of Guard Channel (243.000 MHz). To constantly monitor the guard channel while in the normal mode of operation, proceed as follows:

(1) To monitor the guard channel, follow the turn-on procedure and rotate the function switch to the BOTH position.

NOTE

The radio set will now operate in the normal mode and monitor the guard frequency (243.000 MHz).

e. Guard Operation. To operate in the guard mode of operation only, the radio set's guard receiver is disabled and the main receiver is tuned to the guard frequency. To accomplish this, proceed as follows:

(1) To operate in GUARD, rotate the M-P-G switch to GUARD position.

NOTE

The main receiver and transmitter are now tuned to the guard frequency (243.000 MHz).

f. Automatic Direction Finding (ADF). Normal radio transmissions are not possible with the function switch in the ADF position. For ADF capability, proceed as follows.

(1) Turn on the radio in accordance with turn-on procedures.

(2) Set the function switch to ADF position.

(3) Refer to the applicable technical manual for operation of ADF equipment.

2-5. AJ MODE OPERATING PROCEDURES. The AJ mode programs the radio with a frequency-hopping pattern and rate to provide a jam-resistant capability. Three inputs are needed for entering AJ mode: time-of-day (TOD), word-of-day (WOD), and the net number. Included in subsequent paragraphs are procedures for sending and receiving TOD, procedures for loading word-of-day, and specific procedures for operation of the RT. Because there are two methods of entering WOD (specifically: single WOD loading, which can be utilized by either URC-99 or -99A; and multiple WOD (MWOD) loading, which can be used only by URC-99A), the following paragraphs must be read and followed carefully to prevent errors in loading WOD or attempting to enter the AJ mode of operation.

a. Typical AJ Mode Entry Outline. Following is an outline of the required entries and operations for entering AJ mode operation.

(1) Turn on the radio in accordance with turn-on procedure (paragraph 2-4a.).

(2) Receive TOD in accordance with paragraph 2-5b.

(3) Install WOD in accordance with the following guidelines:

(a) If entering AJ mode by normal Have Quick method (single WOD) using URC-99 or -99A, refer to paragraph 2-5d(1) to load WOD, then proceed to step (5).

(b) If entering AJ mode by multiple WOD method (MWOD), refer to URC-99A mode setup procedures (paragraph 2-5c.), and then install WOD in accordance with URC-99A MWOD loading procedure found in paragraph 2-5d(2).

(4) Enter the verify/operate mode in accordance with paragraph 2-5c.

(5) Enter the net number in accordance with paragraph 2-5f.

(6) The radio is now set to enter the AJ mode of operation. Once the T-2-3-A switch is set to the A position, the radio is in AJ mode, and can communicate with other similarly equipped radios that have the same WOD, TOD, and net number.

NOTE

A steady warning tone will be heard in the headset when the AJ mode is selected and TOD, or a valid WOD has not been entered. A pulsating warning tone will be heard in the headset when an invalid operating net is selected (URC-99A only).

b. Time-of-Day (TOD) Procedures. The following procedures instruct how to receive TOD, how to send TOD, and how to accomplish emergency clock start.

(1) Receiving TOD.

NOTE

After power-up, the RT automatically accepts the first TOD message received.

(a) Use the frequency switches in the manual mode or the channel switch in the PRESET MODE to select a predesignated frequency or net.

(b) Momentarily select the T position on the T-2-3-A switch and then return to predesignated frequency.

NOTE

If time is being automatically beaconed, the first TOD message received within one minute of selecting the T position will be accepted. A TOD update can be made in either the AJ or normal mode.

(c) If time is not being automatically beaconed, request TOD from another station. Listen for a momentary two-tone signal followed by a single tone.

(2) Sending TOD.

(a) Use the frequency switches in the manual mode or the channel switch in the PRESET mode to select a predesignated frequency or net.

(b) Press TONE switch.

(3) Emergency TOD Clock Start.

(a) Rotate and hold the T-2-3-A switch in the T position.

NOTE

To preclude an inadvertent transmission of the new TOD in step (2), release the TONE pushbutton prior to releasing the T-2-3-A switch from the T position.

(b) Press and release the TONE pushbutton.

(c) Release the T-2-3-A switch and return to predesignated frequency.

NOTE

The radio will not communicate with any other ECCM-equipped radio(s) unless this new TOD signal is transmitted to the other radio(s).

c. URC-99A Mode Setup Procedures. Four programming modes control everything necessary to load the radio for AJ mode of operation. Table 2-3 lists the four functions.

Table 2-3. MWOD Functions

Frequency	Function
220.000	Verify/Operate
220.025	MWOD Load
220.050	MWOD Erase
220.075	Frequency Management
	Training Change

After the radio has been turned on, to enter any of these modes, proceed as follows:

(1) Set the channel switch to 20.

(2) Rotate the M-P-G switch to PRESET position.

(3) Use the frequency switches to enter the appropriate frequency setting for the applicable mode.

(4) After lifting the access cover assembly, press and release the PRESET pushbutton.

(5) The radio is now in the selected mode.

(6) Set M-P-G switch to MANUAL.

d. Word-of-Day (WOD) Loading Procedures. Word-of-day can be loaded in the following ways: Have Quick single WOD method, see paragraph 2-5d(1); and URC-99A MWOD method, see paragraph 2-5d(2).

(1) Single WOD Loading. During the transition from single to multiple WOD operation, the single WOD method is still available. This procedure can be utilized for URC-99 and URC-99A radio sets. To use the single WOD method, proceed as follows.

(a) Turn on the radio in accordance with the turn-on procedure.

(b) Rotate the M-P-G switch to the PRESET position.

(c) Using the channel switch, select channel 20.

(d) Using the frequency switches, select the WOD element.

(e) After lifting the access cover assembly, press and release the PRESET pushbutton.

NOTE

The WOD elements are entered into memory through the channels 15 through 20. The WOD varies in length and will require anywhere from one to six of these channels, starting with channel 20 and working backward to 15.

(f) Using the channel switch, select the next lower channel.

(g) Repeat steps 4 through 6 until all elements of the WOD are loaded.

NOTE

The following step is accomplished by the radio set immediately after power-up.

(h) Initialize the radio by first using the channel switch to select channel 20, listening for beeps in the headset. Then, using the channel switch, progressively select the next lower channel until a double beep is heard in the headset. (A double beep indicates that the WOD elements have been transferred to volatile memory.)

(i) Close the access cover assembly.

(2) MWOD Loading. MWOD capability allows for up to six WODs to be loaded at one time, and each WOD will be tagged with a unique date code. When the current operational date is updated in the radio, the code generator will automatically be reinitialized with a new WOD having the same date. This procedure can be utilized only for URC-99A radio set.

(a) MWOD Loading Procedure. To accomplish MWOD loading, proceed as follows.

NOTE

In the following steps, WOD elements will be entered into memory locations accessed by the channel switch (channels 20 through 15). The elements are not entered into front panel preset memory, they are entered into non-volatile memory located in the SYNTH/ECCM slice. Channel 14 memory location is used to enter the date code necessary for implementation of the WOD. Channel 1 memory location is used for the current operational date (further explanation found in paragraph (b)).

1. Enter MWOD load mode in accordance with paragraph 2-5c.

2. Use five frequency switches to select first WOD element.

3. Press TONE switch. Note a single beep. The first WOD element is now entered.

4. Select next lower memory location with channel switch.

NOTE

All remaining WOD elements may be loaded by repeating steps (6) through (8). A single beep will be heard when the TONE switch is pressed when loading WOD elements.

WOD data is not entered into front panel preset memory. The WOD elements are entered into non-volatile memory locations accessed by the channel switch, and are entered with the TONE switch while in manual mode. If the radio is switched off or power is lost after entry of WOD and date codes, the data will not be lost, therefore, all of the information entered will remain in force until manually changed.

Because multiple WOD's may be entered in the MWOD system, a date code is associated with each new WOD which specifies the day of the month it is to be utilized. The date is required to uniquely identify the appropriate WOD when reinitializing the code generator at midnight transitions. After the first complete WOD is entered, to enter the corresponding date codes, proceed as follows.

5. Use channel switch to select channel 14.

NOTE

Day of the month date code entry for the WOD is represented by the format 3AB.000, where A = tens (0, 1, 2, or 3), and B = units (0 through 9). Examples: 301.000 = first day of month, 331.000 = thirty-first day of the month.

6. Enter the applicable date code using the frequency switches.

7. Press TONE switch. Note a double beep. The date code is now entered.

NOTE

One complete WOD has now been entered. To enter additional WODs, re-select channel 20, and perform steps 2 through 7. The radio will retain the six most recently entered WODs. Previously entered WODs which are no longer among the six most recent are erased. If a WOD is entered having a duplicate date as one which was previously entered, the new entry will take precedence and will be identified as being the most recent entry. Once the WOD information has been entered, the operational date must be entered. To enter the operational date, proceed to paragraph (b).

(b) Operational Date. The operational date is the current (GMT) date, and must be entered into the system so the radio can select one of the WOD's for code generator initialization. If the aircraft is powered down after MWOD is loaded, MWOD will not be lost, but the operational date will. If TOD being received contains the operational date as part of the TOD message, there is no need to do the following procedure. However, if it is necessary to enter the operational date manually proceed as follows.

(1) Enter MWOD load mode in accordance with paragraph 2-5c. (If radio is already in MWOD load mode, proceed to step 2.)

(2) Set channel switch to 1.

(3) Using the same format as shown for the date code, enter the operational date with the frequency switches.

(4) Press TONE switch. The operational date is now entered.

(5) Enter verify/operate mode in accordance with paragraph 2-5c.

e. Verify/Operate Procedure. The verify/operate mode performs a dual function. It is used to enter the AJ operate mode, and is also used to verify that the WOD(s) entered has the proper date code attached to it.

(1) Operate. To enter the verify/operate mode for AJ mode operation, enter the verify/operate mode in accordance with paragraph 2-5e.

(2) Verify. To verify the date codes of the WOD elements, proceed as follows.

(a) Turn on the radio in accordance with the turn-on procedure.

(b) Enter verify/operate mode in accordance with paragraph 2-5c.

(c) Using the tens (10) and units (01) frequency switches, select the date to be verified.

(d) Using the channel switch, select 20, then 19, and then 20. Listen for a single beep in the headset.

NOTE

The single beep verifies that an MWOD with a matching date code is entered into memory.

(e) Repeat steps 3 and 4 until all of the desired date codes have been verified.

(f) Close the access cover assembly.

f. Net Numbers. Setting A on the T-2-3-A switch overrides the hundreds digit in both the manual and the preset mode, puts the radio in the AJ mode, and programs the radio to use the net number inserted in the three digits following the A. To use the net numbers, use the following instructions.

(1) If TOD and WOD have not been entered, follow the instructions for loading the TOD and WOD.

(2) Set the M-P-G switch to MANUAL or PRESET.

(3) If:

(a) M-P-G switch is set to MANUAL set the three center frequency switches to the desired net number.

(b) M-P-G switch is set to PRESET, set the channel switch to a preset containing the desired net number in its second, third, or fourth digits.

(c) Set the T-2-3-A switch to A.

NOTE

A steady warning tone will be heard in the headset when the AJ mode is selected and TOD, or a valid WOD has not been entered. A pulsating warning tone will be heard in the headset when an invalid operating net is selected (URC-99A only).

g. Word-of-Day Erasure. The erase mode is used to clear the memory of all WOD elements. To accomplish WOD erasure, proceed as follows.

(1) Enter erase mode in accordance with paragraph 2-5c.

(2) Press and release the TONE pushbutton. When the TONE pushbutton is pressed, all WODs are completely erased.

NOTE

An alternate and quicker method of MWOD erasure is to set the control's T-2-3-A switch to "T" position and hold; then press the PRESET button.

(3) Enter verify/operate mode in accordance with paragraph 2-5c.

h. Frequency Management Training Change (FMT Change). To change any or all of the frequency management training net frequencies, proceed as follows.

(1) Enter the FMT change mode in accordance with paragraph 2-5c.

(2) Using the channel switch, select the appropriate channel.

(3) Using the frequency switches, select the first frequency change.

(4) Press and release the TONE pushbutton.

(5) Repeat steps 2 through 4 until all frequency changes are loaded.

(6) Enter verify/operate mode in accordance with paragraph 2-5c.

i. WOD Elements for Training. For training and maintenance use the following WOD elements with the corresponding preset channels.

PRESET	WOD ELEMENT
20	300.050
19	376.000
18	359.100
17	314.300
16	297.600
15	287.400
14	Date Code
1	Operational Date

(1) Enter MWOD load mode in accordance with paragraph 2-5c.

(2) Load the above WOD elements in accordance with paragraph 2-5d(2)a., (MWOD loading procedure).

(3) Enter verify/operate mode in accordance with paragraph 2-5c.

NOTE

At this time, if a net number ending with 00 is selected, the radio will operate in the T-net (Have Quick) training mode; and if a net number ending in 25 is selected, the radio will operate in the FMT-net training mode. The FMT-net training mode forces the radio to hop between the sixteen FMT-net training frequencies. The T-net training mode will use the frequencies loaded in with the WOD. Also, for T-net operation, the WOD element loaded into preset 19 will determine if conferencing (paragraph 2-5j.) is enabled or disabled. A WOD element ending in 00/50 will enable conferencing, and 25/75 will disable conferencing. For FMT-net operation, conferencing is always enabled. To change any or all of the sixteen FMT-net frequencies, refer to paragraph 2-5h.

j. Conference Capability. In the AJ mode, the RT has the ability to receive and process two simultaneous transmissions on the same net. (Three simultaneous transmissions will result in garbled reception.) With URC-99 radios, conferencing is controlled by the last two digits of the net number (25-disable; 00, 50, or 75-enable). With URC-99A radios, conferencing is controlled by the WOD element loaded into channel 19. If the WOD element in channel 19 ends with 00/50, conferencing will be enabled, and, if the WOD element ends with 25/75 conferencing will be disabled.

NOTE

When operating in the secure voice mode, conferencing is automatically disabled.

k. Guard Operation. The guard operation is not affected by operations in the AJ mode. Guard frequency may be monitored regardless of what mode the radio is in as long as the function selector is in the BOTH position. Selecting GUARD on the M-P-G switch disables the AJ mode, puts the main receiver/transmitter on frequency 243.000 MHz, and disables the guard receiver.

2-6. SECURE VOICE.

a. For secure voice, obtain from the COMSEC custodian the proper COMSEC equipment and the proper variables.

b. After following the radio's turn-on procedure, refer to the applicable technical manual for operation of the associated COMSEC equipment.

NOTE

The radio in normal mode is capable of secure voice operation with the KY-28, KY-57, or KY-58, but is not capable of secure voice AJ mode operation with the KY-28.

c. The radio set can be operated in the secure normal mode or the secure AJ mode. For secure normal two-way voice communication, use the COMSEC equipment and operate the radio as usual for two-way voice. For secure AJ two-way voice communication, use the COMSEC equipment and follow the procedures for AJ mode operation.

Section III. EMERGENCY OPERATION

2-7. EMERGENCY OPERATION. Included in this section are procedures concerning information and instructions for eliminating a jamming condition that has been encountered when operating in the normal mode of operation. There are also some conditions where the radio set may encounter some jamming when in the AJ mode of operation, and the following procedures will alleviate those conditions. In situations where power might be lost it is essential to maintain power to the rubidium oscillator in the MT-6165 mount. Included in the mount and control circuitry is a keep-alive circuit for this function, which is explained more fully in the following paragraphs.

a. Jamming Conditions When in Normal Mode. To counter a jamming condition when in the normal mode, proceed as follows.

(1) If your radio has been loaded with a Have Quick single WOD, set the T-2-3-A switch to the A position. If the radio has not received TOD, receive TOD in accordance with paragraph 2-5b(1). If it is necessary to perform emergency clock start, proceed to paragraph 2-5b(3). After all other stations have entered the AJ mode with the same WOD and TOD, jam-free communications are possible.

(2) If your radio has been loaded with MWOD, but no TOD, receive TOD in accordance with paragraph 2-5b(1). If it is necessary to perform emergency clock start, proceed to paragraph 2-5b(3). If necessary, insert an operational date code in accordance with paragraph 2-5d(2)(b), then enter verify/operate mode in accordance with paragraph 2-5c. After all stations have entered the AJ mode with the same WOD and TOD, jam-free communications are possible.

(3) If your radio has been loaded with a valid WOD and TOD, all that is necessary to counter jamming, is to set the T-2-3-A switch to the A position, and insert the rest of the net number.

b. Jamming Conditions When in the AJ Mode. The only situation where jamming can occur in the AJ mode is when operating in the BOTH position of the function switch (guard receiver enabled). To counter this condition, set the function switch to MAIN position.

c. Keep-Alive Switch Operating Procedures. The rubidium oscillator in the MT-6165 mount requires a 10 minute warmup period. If power is interrupted or lost to a central, the oscillator can be
kept powered up through a keep-alive cable attached to the battery of the vehicle housing the central. To keep power to the oscillator, set the KEEP ALIVE switch on the mount housing front panel to ON. The KEEP ALIVE switch on the control unit is also for maintaining power to the control in the event of an interruption of power.

NOTE

When it is no longer necessary to power up the oscillator, set the KEEP ALIVE switch to OFF; otherwise, the vehicle battery will be drained.

INDEX

SUBJECT	PARA./TABLE/FIG.
A	
Abbreviations	T1-4
AJ Mode Operating Procedures	2-5
Automatic Direction Finding	2-4f
C	
Capabilities and Limitations	T1-2
Conference Capability	2-5j
Constant Monitoring of Guard Channel	2-4d
Controls, Indicators, and Connectors	2-1,T2-1,F2-1
D	
Description of Equipment	1-1
E	
Emergency TOD Clock Start	2-5b
Emergency Operation	2-7
Equipment Characteristics	1-8,T1-1
Erase Mode	2-5g
F	
Frequency Management Training Change	2-5h
G	
Guard Operation	2-4e, 2-5k
H	
URC-99A Mode Setup	2-5c
J	
Jamming Conditions - Normal Mode	2-7a
Jamming Conditions - AJ Mode	2-7b
K	
Keep Alive	2-7c

INDEX (Continued)

SUBJECT	PARA./TABLE/FIG.
L	
Leading Particulars	T1-1
M	
MWOD Load Mode	2-5d
N	
Net Numbers	2-5f
Normal Mode Operating Procedures	2-4
Normal Two Way Voice Operating	2-4c
O	
Operation Instructions	2-2
Operating Procedures	2-3
P	
Preset Channel Loading	2-4b
Purpose of Equipment	1-2
R	
Receiving TOD	2-5b
Related Publications	T1-3
S	
Secure Voice Operation	2-6
Sending TOD	2-5b
T	
Time-of-Day (TOD) Procedures	2-5b
TOD Definition	1-6
Turn-On Procedure	2-4
V	
Verify/Operate Mode	2-5c
Verify/Operate Procedure	2-5e

INDEX (Continued)

SUBJECT	PARA./TABLE/FIG.
W	
WOD Definition	1-5
WOD Elements for Training	2-5i
Word-of-Day Erasure	2-5g
Word-of-Day (WOD) Loading	2-5d
Single WOD Loading	2-5d
MWOD Loading	2-5d